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Scientific advisor: Aksenova N.V., PhD in Literature, associate professor.

А.И. Наурусов, А.К. Теркина

Национальный исследовательский

Томский политехнический университет

Monge Gaspard. Founder of the Language of Engineers

The article considers the worldview of the great geometer Gaspar Monge, his vision of the development of descriptive geometry. Also, the vision of science in modern manuals and textbooks is considered. The purpose of the article is to get acquainted with the worldview of Gaspar Monge, to compare the scientist's worldview with the modern course program of descriptive geometry.

Key words: Gaspard Monge; descriptive geometry; engineering graphics; development; language.

Introduction. The application of geometry goes back thousands of years. It arose with the development of various crafts, culture, arts, with human labor activity and observation of the surrounding world. This is indicated by the

names of geometric shapes: «cone», «conos» – pine cone; «line», «linum» – linen thread.

The need for images of objects on a plane appeared among people in ancient times. This is evidenced by numerous images of primitive man on the walls of caves, where he tried to graphically tell about important events in his life.

With the development of the human perception of the world, the exact sciences, art and industry developed at the same time. From this emerged the need for descriptive geometry [4].

Gaspard Monge's views on descriptive geometry. The Creator of orthogonal projections and the founder of descriptive geometry as a science is recognized as the French geometer Gaspard Monge (1746-1818). He systematized and generalized knowledge about the methods of depicting spatial figures and the creation of a unified mathematical science on the theory and practice of depicting spatial objects on a plane. This is how Monge was able to make descriptive geometry one of the most important disciplines in science.

In 1798, he published his work «Descriptive Geometry», in which he proposed to consider a planar drawing consisting of two projections as the result of combining two mutually perpendicular planes of projections. This alignment is achieved by rotating the planes around the line of their intersection, which later became known as the «axis of projections».

In his work «Descriptive geometry» the author sees several goals. In the first place, his goal was to create conditions for the French people so that they would no longer be dependent on foreign industry. He believed that his people should strive for precision. So, he wanted to raise the level of education in the country. On the second place he had a different goal - to learn about the world. He wanted to unravel as many laws of nature as he could, which would help industry.

Gaspar Monge believed that descriptive geometry as a science has two main purposes. Firstly, descriptive geometry is a language that is necessary for an engineer creating a project. It is also a language for those who have to manage the implementation of the project, and, finally, for craftsmen who have to manufacture various parts themselves. For example, using this language, you can represent a three-dimensional object in a drawing, having accurate data on the position of two dimensions of the object. Indeed, the drawing is a language structure for the exchange of technical information. Experts know that morphological features allow native speakers to get a certain idea of the content of what is said or written.

As a second purpose, Gaspar sees an accurate description of bodies. More precisely, it is one of the methods of investigating truth. Indeed, man is always trying to get at the truth, by moving from the unknown to the sought after. In

this way we develop our mental faculties, thereby developing the human worldview even more strongly. Also, we should not forget that at the end of the 18th century, industry was developing very slowly, so he thought this goal should be pursued by workers who give objects different forms.

At the end of the seventeenth century, descriptive geometry was almost not taught in schools, as the French geometer notes in his work. He writes that scientists had little interest in this science. He also observes that descriptive geometry was applied in a vague way by people who could not articulate the results of their reflections. A simple oral course in descriptive geometry would therefore have been totally pointless in those days.

Gaspar Monge found two remarkable applications of descriptive geometry, both in their generalizations and in their inventiveness. These are the construction of perspective and the precise definition of shadows in a drawing. These two can be seen as complementary to the art of describing objects [2, p. 9–10].

Descriptive geometry in the modern world. In the textbooks offered by modern institutions of higher education it is accepted that descriptive geometry is an essential discipline on which the engineering curriculum is based. This discipline allows you to learn all the necessary methods for representing three-dimensional objects in the plane. It is impossible to imagine a subject fully enough by its even most detailed description. However, this is easy to do with a projection drawing of the object and its visual representation. The methods of representation of descriptive geometry allow to display both existing objects and images of projected objects with great clarity and metric reliability [3, p. 3–4].

In life, various images surround us everywhere. These are posters and photos, advertisements and signs in front of stores, movie frames, etc. But we will be interested in images of objects, which in the future should be made in production. At the same time, one person will make such images, and another person will produce the object according to them in production. Consequently, both must not only see the shape of a three-dimensional object from its two-dimensional image, but also be able to solve geometric problems to determine the size of the object and its individual parts, as well as to determine the relative position of individual elements of the object.

Among the subjects studied in a technical university, applied technical drawing is of particular importance. It is one of the ways to express engineering thought in graphic form. In order to master the language of technical drawing, it is necessary first of all to study the rules («alphabet» and «grammar») of drawing and reading images.

The «ABCs» of a drawing are all those types of lines that are used in its execution (solid, dashed, dashed-point, etc.) and that students study in the

course of mechanical engineering drawing. It is the descriptive geometry that defines the strict rules for drawing. Although a plane can only be characterized by length and width (that is, the plane has only two dimensions), by following the rules of descriptive geometry we can define three parameters in the plane: length, width, height (that is, to define three dimensions in the plane). Thus, we can say that descriptive geometry is the grammar of drawing. [6, p. 7–8].

According to such geometers as E.S. Fedorova, I.I. Kotov and others. To date, descriptive geometry is considered as the science of the methods used to build models of space.

Moreover, such geometers as O.A. Volberga, E.A. Mchedlishvili call descriptive geometry as a constructive branch of projective geometry, which studies the projective relations of spaces with planar models of these spaces. This method is suitable only for planar space, allowing transformations of objects as in mapped Euclidean space.

I would also like to mention Gaspard Monge, whose formulations were written above, because these interpretations repeat his goals. Monge mentioned in his works that it is easy to display a three-dimensional object on a drawing by having the exact position data of the two dimensions of the object.

There is an opinion that the lack of traditional descriptive geometry's own axiomatics is paradoxical, as it stands apart from other geometric systems in this respect.

The content of classical descriptive geometry is emasculated by the introduction of information from other mathematical disciplines, which, in the absence of a unified definition of science, its objectives, subject and method of research makes it a set of disparate information from various academic disciplines. Thus, there is a contradiction between the content of the theory of images for creative specialties and its ability to achieve the main goal of its study – formation of creative thinking of students – architects, designers, designers [5].

Conclusion. After the publication of «Descriptive Geometry» by Gaspard Monge, the new science brought to life by the genius of Monge, due to the urgent need on the part of engineering construction equipment, began to spread rapidly not only in France, but also in other countries. For the first time, Monge's work was printed precisely as a textbook.

We believe Monge's work is very valuable. Of course, we completely agree with Gaspard's opinion that descriptive geometry is the language of an engineer. The expression is appropriate here: «Descriptive geometry - grammar of a technical language (drawing)».

Indeed, a person who has no idea about the rules of reading and making a drawing will not be able to understand it and work with it further. If we draw a parallel with the grammatical rules, we can distinguish the main and auxiliary

images and projections. This is similar to the main and auxiliary members of a sentence. In sentence construction, it is important to make a logical connection between the various members of a sentence. In descriptive geometry, as in grammar, it is important to connect the elements of the image with projective connections [1].

Thus, engineering graphics is the oldest graphic language of human culture. As a discipline, it gives the knowledge and skills to build and read drawings, and is the basis in the formation of basic knowledge. In turn, the drawing is one of the main carriers of technical information, without which no enterprise can do without.

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Scientific supervisor: Aksenova N.V., PhD in Literature, associate professor.